Application of the 3/omega Method to Glass Transition Phenomena in 2-Butoxyethanol Isomers

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Relaxation phenomena at the glass transition in 2-n-, -iso- and -tert-butoxyethanol were studied by heat capacity spectroscopy. At first the equilibrium heat capacity measurements were made using a high precision home-made adiabatic calorimeter from liquid helium temperature to room temperature. A glass transition was found at 140, 146 and 150 K for -n-, -1so- and -tert- sample, respectively. The -iso- sample could not be crystallized, and no melting point was observed. The frequency dependence of the heat capacity around the glass transition was measured using a heat capacity spectrometer, which was newly constructed on the basis of the so-called 3/omega method. A platinum thin film was used for the heater and at the same time for the thermometer. The measurements could be made precisely for the frequencies from 1 Hz to 10 kHz. The results showed good agreement with those of adiabatic calorimetry beside the glass transition region. The frequency dependence of the heat capacity (the real and imaginary parts) was clearly observed around the glass transition temperature. The dielectric constants were also measured for the same sample in the same apparatus, and the results were in good agreement with those of heat capacity spectroscopy. The temperature dependence of the relaxation frequency was fitted with Vogel-Fulcher-Tammann equation. The results indicate that the motion in supercooled liquid is strongly correlated with each other molecule. The Davidson-Cole parameter beta of -tert- is smaller than the others, which indicates that the distribution of relaxation frequencies in -tert- is widely spread.